S
CONTROL
Insect
Spruce Budworm
Deerlodge
So. Continental Unit, 1957

SPRUCE BUDWORM PROJECT REPORT

SOUTH CONTINENTAL UNIT - 1957

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1. The following comprises the report on the 1957 South Continental Spruce Budworm Control Project.

2. Geographical description - The South Continental Control Unit included the northwestern portion of the Beaverhead N.F. and the southeastern portion of the Deerlodge. The area extended from township 3 north to township 4 south and from range 5 west to range 15 west, principle meridan, Montana. Total net acreage treated is 245,333 acres, gross acreage treated 249,473.

3. Spruce Budworm - Choristoneura fumiferana (Clem.)
Heavy (over 75 percent infested) - 31 percent of the unit.
Medium (50 - 75 percent) - 43 percent of the unit.
Low (5 - 50 percent) - 26 percent of the unit.

4. Damages to date.

(a) Tree species and age classes.
The tree species infested are Douglas fir, Alpine fir and Engelmann spruce occurring in both pure and mixed stands and commonly associated with lodgepole pine where bordering that type.

Even aged and uneven aged stands are common in all species. Age classes under 40 years are common only in mixed aged stands. Old age classes including over mature stands are common.

(b) Timber values.
It is estimated that 1,000 M feet bm of timber with present stumpage value estimated at $25,000.00 has been killed by the infestation. Because the timber which has been killed is scattered it is not salvageable. An estimated 70,000 M feet bm with present stumpage value estimated at $350,000.00 was immediately threatened and approximately 700,000 M feet bm of timber was ultimately threatened. This value includes an estimated annual loss of $10,000.00.per year in the Christmas tree sales.

(c) Watershed values.
A part of the Butte, Montana city water supply and an important part of the irrigation water supply for the Deerlodge, Whitehall and Big Hole valleys flows from this area. Much of the unit is typical of shallow soils generally unsuited in this zone for other than Douglas fir tree growth.

(d) Recreation values.
U.S. Highway 10S and Highway 91 extend through the unit. Heavy local and interstate and international tourist travel (latter from Canada) use or pass through unit. Three transcontinental railroads cross the unit in addition to one local incorporated railroad. The unit includes Thompson Park a large area set aside for a park for the city of Butte through cooperative agreement with the Forest Service. Many areas within the unit are used locally and by tourists for camping, picnicing, fishing and hunting. The Big Hole River recognized for trout fishing nationally extends through the unit from Wisdom to Twin Bridges, Montana.

5. Training of the first development checkers began on June 4th. Regular development checking was done by two crews on June 10 with all five crews assigned by June 13. The last development check was made on July 13.

The first prespray population and spray card lines were completed on July 1 and the first blocks were released and spraying began on July 2. Spraying was completed on July 17 and the final mortality samples were taken on July 26.

6. Pre-control surveys were made first by an aerial check by Mr. Tom Terrill of the F.I.L. and second by J. Davis, F. Wild and H. Rowland on ground checks during August and the first half of September, 1956, using standards as set by the Forest Insect Laboratory in Missoula. The block boundaries were established in December 1956 and January 1957 by Merle Hofferber and Harvey Rowland. One weakness in the detection surveys made in the fall is the impossibility of determining the actual amount of defoliation due to spruce budworm activity and that due to other defoliators. A second difficulty is due to the fact that the detection survey cannot observe the spread and change in intensity, if any, due to the current season's moth flight. This second weakness of the survey caused little change in operation plans on the unit with the possible exception of the Willow Creek - Gregson area and the ground check of Lacy Creek made this June.

7. (a) Aerial spraying of insecticide composed on one pound of DDT, one quart of hydrocarbon emulsifier and sufficient #2 diesel oil to make one gallon - applied at approximately one gallon per acre in the control program. Minimum deposition on spray cards was to be .20 gal./acre unless a ground check of vegetation and budworm mortality indicated sufficient control in a block unit with less than the minimum required deposition.

One portion of the unit (Blocks 77 through 84) was used as a height of spray study area. Only one plane, a B-18, was used to spray these blocks. During the spraying of this area, cards indicated light and irregular deposition in blocks 81 and 82. When a statement was made that a portion of these blocks should be resprayed it was requested that no respray be done in the study area as it would seriously effect the data obtained. Total acreage of the study area was 30,170 acres, but only 27,613-9/10 gallons was metered out for spraying by the B-18 on the eight blocks.

7. (b) Respray work was required in varying amounts on parts of 15 different blocks. The numbers of these blocks and the average depositions as recorded by spray cards were as follows: #2 - .01, #6 - .05, #13 - .145, #18 - .043, #28 - .03, #30 - .086, #32 - .181, #42 - .145, #55 - .133, #50 - (ground check only), #60 - .128, #62 - .09, #71 - .01, #72 - .079, #64 - .16. Checks were also made on the ground in all cases before need for respray work was ordered. Total acreage requiring respray amounted to 8,695 acres or about 3½ percent of the net area. Details on reports on ground checks and spray cards before and after respray work are a part of the appendix section of this report. A map of each area requiring respray work which shows the location of spray card lines and ground check routes is also included in this report.

On blocks 18, 13, 32 and 30 exceptionally turbulent air conditions were encountered at all periods of the flying day.

On areas 55, 64, 59, 42, 71 and 72, certain special flying procedures were recommended so as to provide maximum protection toward keeping fishing streams and reservoirs free of spray deposition. On the remainder of the blocks requiring respray work no special clause was noted for the unsatisfactory deposition coverage on the initial spray job on these blocks. In all cases the observer reports indicated satisfactory spray action and flying on the same areas where the deposition was too light to be accepted without respraying.

8. A summary of comments on aircraft used is as follows:

Aircraft	Number	Comments
Ford-Trimotor	1	Excellent for short hauls and rough terrain. Rather slow and light on carrying capacity. Can be used off rough short land fields. Pilot excellent.
C-82 Fairchild Packet	2	Versatile aircraft giving a good performance record on all areas except the precipitous box canyon type of spray blocks. Spray work by Pilot Powers was outstanding in regard to completeness, existing deposition standards and acreage. Pilot Christler was new to this terrain. Pilot Gentry was used only one day.
B-17 Flying Fortress	2	Good spray craft for long hauls and able to fly most all terrain. Needs longer runways than most aircraft used in spraying. Safety margin of 4 engines desireable for long flights over rough country. Pilots Dwyer and Biegert and copilots were excellent. Spray jets may not have been properly adjusted on B-17 piloted by Dwyer as flying control appeared to be excellent but deposition on ground was light in some cases.

Aircraft	Numbers	Comments
B-18	1	Good spray craft. Worked in all types of terrain without any special difficulties. Was assigned entirely to "Height of Flight Study" area in Blocks #77 to 84 inclusive. Further comments on pilot and plane will be covered on report on "Height of Flight Study".
TBM	1	Good spray plane - may be too fast for spraying above 7000 foot elevation. Pilot Eyster operated on this project only a short time. He appeared to be a first class pilot.
Beechcraft Bonanza	3	Used for observation. This plane came up for some discussion concerning the advantage s and disadvantages of high-winged and low-winged aircraft. This low-winged type of plane was used for approximately 130 hours of observing and briefing on the S. Continental Unit. The rear seat is not too good for observing, however, this position is poor in most aircraft. With the use of obsolete military aircraft, speed is important in being able to keep up with and to get out to the areas in sufficient time to observe the initial runs.
Cessna 195	1	This plane was used on one trip for pilot briefing. This plane has poor visibility forward and backward. It appears to me to be an excellent performing aircraft. Observation plane pilots Mooney, Shallerbarger, Delaney and Thurmond were very satisfactory.

9. Eighty spray blocks were originally established for the control unit. Block 27 was divided to permit spraying of an isolated 160 acre portion on a low south slope before remainder of block was treated. Block 38 was divided to permit pilot to have more uniform spray area and to get earlier treatment of a low south slope. Block 50A was dropped from the unit and the boundaries of blocks 48 and 49 changed to exclude the major portion of the Anaconda Company land from the spray area. Block size seemed adequate. Several blocks were treated as one unit by the spray pilots, but this caused little additional administrative control work. It is recommended that the same block size be used in the future if the same or similar planes are used.

10. Forest Service organization.
The total number of men used on the project by classification and man-days was as follows:

Grade	Number of men	Man-days
GS-11	2	71
GS-7	1	40
GS-6	2	61
GS-5	3	72
GS-4	25	481
GS-3	10	48
Laborers	7	48

(a) Overhead
Unit Supervisor, Assistant Unit Supervisor and Administrative Assistant were adequate overhead for the general operations phase of the project. They were capably aided at the operation base by a TM Assistant man (Frank Krieg) who was delegated certain administrative responsibilities for coorelation of many details in preparedness, record analysis and posting, airport maintenance and eventually spray observation duties when certain phases of operation base maintenance became routine.

The project biologist and two assistant biologists were adequate overhead under the dircumstances for the laboratory and field entomology work. For this size unit and especially with very rapid development of larvae just prior to release of blocks as occurred this year one additional assistant biologist would normally have been necessary. This additional load was carried, however, by Richard Schmitz of F.I.L. who was assigned to this unit to make accuracy checks on development checkers.

Pilot briefing was done mainly by either the Unit Supervisor or the Assistant Unit Supervisor. The general plan was to brief immediately after spraying operations each morning. This was not possible during the early period of the job when new planes were arriving daily and briefing time limited thereby to late afternoon or evening. Evening briefing was also necessary when the latest reports on "ripe" blocks became available only after the current day's work in the field by the development checker. Such findings made it possible to release and combine blocks for spraying with the large planes which eliminated many irregular boundaries of single blocks which may have been released for spraying a day earlier. Briefing time varied from 35 minutes to more commonly one hour or more. With seven pilots to brief this work required about 3 hours of flying time for each briefing officer daily during the height of spraying.

Spraying operations generally ended around 0930. Some pilots preferred to eat breakfast and then return to briefing so that briefing was not completed until 1230 to 1300. The Assistant Unit Supervisor had worked

from 0300 to 1300 and usually had ten straight hours in by that time. He was obliged to spend some additional time with the Unit Biologist and with his weather men in the late afternoon or evening on details of travel routes and communication arrangements for the following morning. This with interruptions usually required 2 - 2½ hours. The same applied to the Unit Supervisor. He was originally scheduled to arrive at the operations base at 0700 and work through the day until 1700 as a trial arrangement. It was soon apparent that through one objective or another he could best serve by being at the operation base by 0330 - 0430 and serve until the end of briefing at 1230 - 1300. Afternoon inquiries, etc, plus the coordinating conference with the unit biologist and the contractors' representatives required 3 - 4 hours and additional time if evening briefing was necessary. A considerable part of this evening time was used in coordinating data reported by the development checkers on "hot" blocks at the end of the current field day. The checkers counted and classified the instar percentages on their day's collection on return to the laboratory.

Some of the evening planning work could have been eliminated if more development checkers could have been made available so that we could have obtained data on more blocks at least every other day when the larvae were developing rapidly over many blocks.

We did not believe we could redeem our full responsibility if we followed the first draft spray schedules made on only the basis of development checker data of the second day preceeding the spray day when a number of blocks were on the verge of pupaeting. When a large number of blocks were released at one time, some blocks on close analysis had higher priority than others based on fourth and sixth instar and pupae development. At the same time there was also a need for combining adjacent blocks into "aircraft days" for more efficient spraying as related to boundaries, terrain and acreage.

Airport
The Butte Municipal Airport was used through lease arrangement with the airport committee who are appointed and responsible to the Silver Bow County Commissioners. The airport committee provided ordinary maintenance to asphalt runways, weather devises at the airport and field communications to aircraft equipped with radio. The Forest Service provided development cost and maintenance including water sprinkling for dust control on all taxiways, parking areas, loading areas, etc., connected with the operation base.

Asphalt runways in excess of 5000 feet were used for taxing and take-off. (See diagram.)

Weather manpower.
Four weathermen were used, each with a mobile FM radio. This arrangement served adequately.

Weather Manpower (Cont.)

The Highland Lookout was used for relay of both weather data and general administration. Blank spots for radio were covered either by an aerial weather flight or the radio technician made a verbal relay from a vantage point. Extreme distances, i.e., Wisdom and upper Wise River were handled by telephone.

The Assistant Unit Supervisor handled the supervision and inspection of the weathermen. No difficulties were experienced. Weathermen should be local people familiar with the main drainages of the spray unit. This simplifies giving directions for the next day's spotting of weather stations.

Biological Manpower

Number	Position	Man-days
10	Development Checkers	255½
9	Spray Card & Mortality Checkers	283
7	Prespray Counters (Women)	48-1/8
1	Auto Mechanic Inspector & Utility	51
22	Assistant Biologist	101-3/8
1	Unit Biologist	53

The biological manpower seemed adequate for the project. If in future projects the number of branches taken on pre-spray population sample is 40 per line instead of 100 which was used on the major portion of this unit, the number of budworm counters can be reduced accordingly. Training seemed adequate except that when development checkers were given spray card and pre-spray population assignments the need for review of their training given about three weeks earlier became obvious. To reduce training time and to insure uniform results all the spray card and mortality personnel should arrive on the unit on the same day instead of at irregular intervals over a ten-day period. Copy of biological safety plan is attached.

The additional help given us by Richard Schmitz of the F.I.L. assigned to this unit, in checking the accuracy of our development checkers in determining the instar percentages, reduced the work load on the biologists. He was also of assistance in the inspection of the field work of the crews. Written instructions to assistants is attached.

10. (b) Coordination between NFA and F.I.L. overhead and NFA biological forces was adequate. Continued coordination will be necessary on future projects.

10. (c) The following transportation equipment was used regularly on the project or assigned temporarily during overload demand periods:

No.	Make	No.	Owner	Address	Miles	Total Cost	Cost Per Mile
1	Jeep		R. Nick	Helena	3333	1057.03	.318
1	Jeep		R. Nick	Helena	1416	609.04	.430
1	Sedan		Reed Motor	Butte	837	209.25	.25
1	Sedan		Reed Motor	Butte	1335	333.75	.25
1	Sedan		Reed Motor	Butte	1133	283.25	.25
1	Station Wagon		Reed Motor	Butte	1589	397.25	.25
1	Jeep		Reed Motor	Butte	2620	786.00	.30
1	Jeep		Reed Motor	Butte	2335	700.50	.30
1	Pickup		Bakke Motor	Missoula	1849	335.25	.182
1	Pickup		Bakke Motor	Missoula	1458	289.18	.191
1	Pickup		SCS	Bozeman	2300	55.20	.024
1	Pickup		SCS	Bozeman	1927	48.17	.025
1	Pickup		SCS	Bozeman	2642	79.26	.031
1	Pickup		SCS	Bozeman	1810	74.21	.041
1	Sedan		SCS	Bozeman	2000	75.00	.0375
1	Panel		SCS	Bozeman	1260	41.58	.033
1	Sedan	#34	USFS	Butte	686	53.11	.077
1	Sedan	#40	USFS	Butte	1586	106.89	.067
1	Pickup	#976	USFS	Butte	1094	156.41	.143
1	Pickup	#754	USFS	Butte	1193	113.34	.095
1	Sedan	#50	USFS	Butte	402	26.55	.066
1	Jeep	#130	USFS	Missoula	1600	85.00	.053
1	Jeep	#138	USFS	Missoula	500	30.00	.06
1	3/4 T Pickup		Joe Brooks	Missoula	621	176.26	.295
1	Pickup		Kitto Transfer	Butte	2285	685.50	.30

10. (c) On the Biology phase of the project the following transportation vehicles were used; 5 Jeeps, 6 pickups, 1 station wagon, 1 sedan. The number and kind of vehicles was adequate but there was no surplus.

Three sedans were provided for the operation base overhead. These were sufficient for transportation needs with no surplus. If a vehicle was not in operable condition it had to be replaced or a shortage existed. A daily inspection was made of all vehicles at the Cleveland School by the mechanic. Deficiencies were corrected before crews left for the field. It is recommended that a mechanic be employed to insure adequate inspection of all vehicles at the start of any similar project and for safety and maintenance during the operation. Written instructions to drivers were posted on bulletin board. See attached driver's check list. A study should be made comparing the cost of operation of privately owned contracted vehicles to that of government vehicles provided for emergency short term use.

The following transportation vehicles were used by the weathermen: 1 Jeep, 2 pickups, 1 sedan, all equipment with 160 MC radios. These vehicles were exchanged between weathermen as the terrain demanded. No difficulties other than battery trouble was experienced. This was overcome by having a charger put on these vehicles each evening.

10. (d) The attached diagram (10-d) explains the communications setup.
Recommendations:
A telephone extension should be placed near the Master Mosaics and progress charts in the laboratory for more efficient conference with the unit biologist.

10. (e) Mosaics
Two Master Mosaic maps on a scale of 2 inches to 1 mile were constructed and mounted on one-quarter inch plywood. Spray blocks were outlined and numbered on these mosaics and special hazards and items of concern in flying and spraying were indicated with different colored water soluble inks (Webers). The mosaics were glued to the plywood with rubber cement. This mounting medium did an excellent job at first, however, when the maps were exposed to moist conditions the glue did not hold and the edges had to be stapled. These large mosaics made ideal maps for basis of plans, action and record and should be considered a must on future projects.

Individual pilot maps and observer maps were constructed from additional copies of the mosaics and mounted on 12 by 14 inch extra heavy cardboard. Each of these mosaics had the same legend as the master mosaic and in addition special items calling for specified action such as fishing streams and lakes, emergency landing fields, etc., were noted. Block acreages were also noted. A one-half inch scale map with spray blocks outlined and numbered was mounted on the reverse side. The pilots were unanimous in their praise of these maps.

RADIO AND TELEPHONE COMMUNICATION

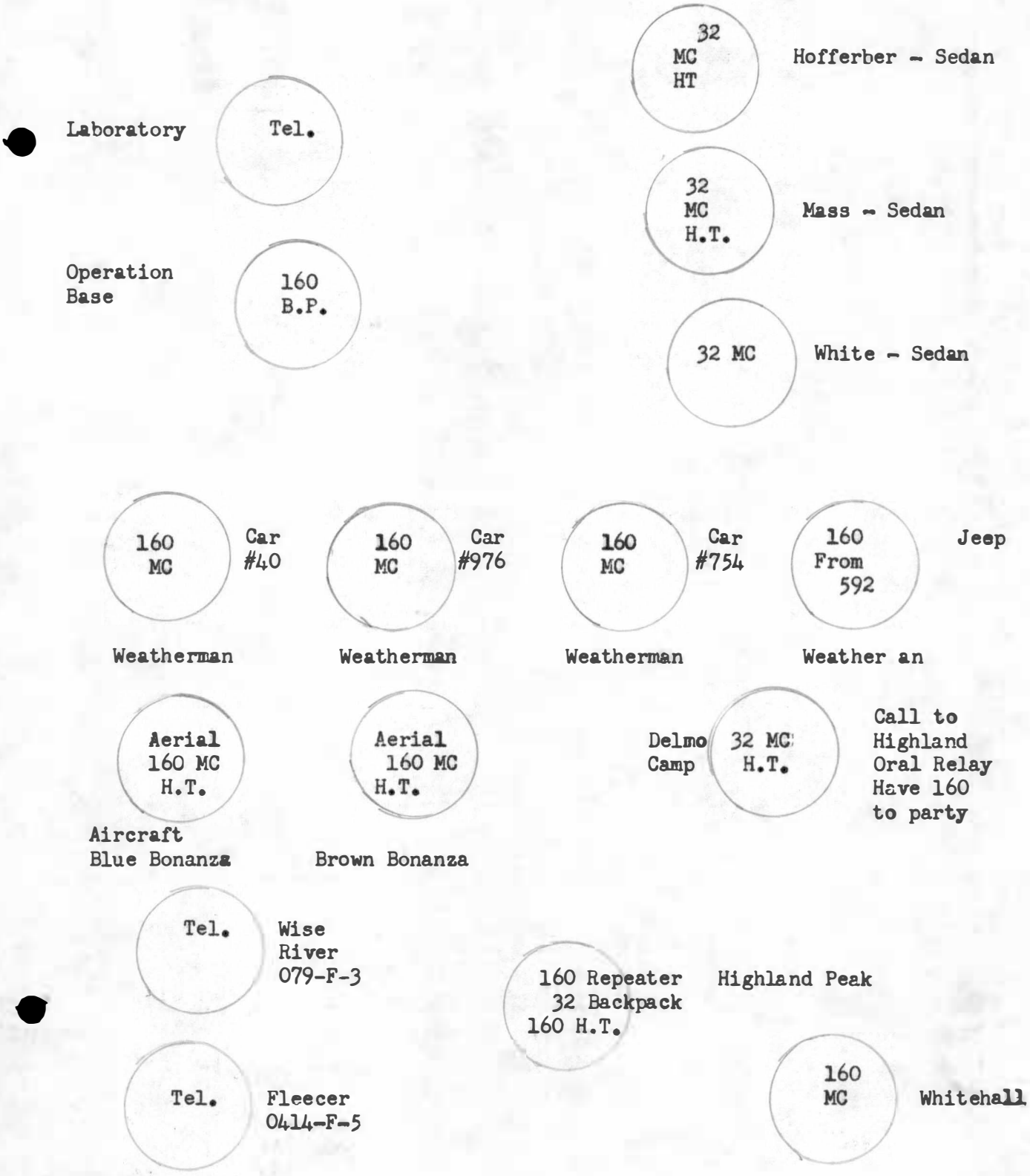

Figure 10-d.

10. (e) Recommendations:
One improvement on the pilot maps would be to show at least all of the blocks immediately adjoining the specific block to be sprayed on each card. The mosaics for observers were made this way and were easier to tie-into the countryside because of a larger field to work with but still were not too large for use in aircraft, (18" x 18"). To provide this, improved pilot mosaics will require at least one additional and possibly two additional copies of mosaics.

(f) SBW forms 15, 17 and 18 are adequate. Form SBW-19 should have the two additional items elevation and slope as indicated on the attached form. The use of two forms SBW-12 "Report of Unsatisfactory Spray Deposit" and SBW-14 "Budworm Population Station Data" as revised, is recommended. The substitution of SBW-19 for the population station form used last year proved unsatisfactory and mimeographed copies of the old form were used on this unit. Some confusion in records of respray acreage would have been eliminated by retention of the use of the F.I.L. SBW-12. Use of the operation chart to replace this form did not allow for the recording of complete data on respray areas.

SBW Forms 2, 6 and 12 are attached showing recommended revisions on the form for more efficient use for the prime use intended.

Additional forms developed on South Continental Unit to facilitate record of control and for check list purposes are attached. Revisions recommended on these forms following 1957 use are shown in ink. These forms are: DAILY AIRPLANE ROSTER, NOTIFICATION TO CONTRACTOR OF DEFICIENCY OR DELAY, UNIT SUPERVISOR'S PROJECT CHECK LIST.

11. Private forest land owner cooperation.
Number of owners - 114 small, 4 large.
Total private acreage - 36,130.
Agreements signed - Small private - 11,055
Large private - 2,595 (includes 1967 acres Anaconda Co.)
Total 12,650
Total acreage for which money collected - 4,713 acres.

Procedures employed - a team made up of a State Forester representative and a Forest Service representative personally contacted all private owners for whom addresses could be found. It required an average of at least two contacts for each agreement signed. The estimated cost for completing these contacts and agreements is $1200.00, based upon an average of three contacts per day for two men at $15.00 each plus mileage. In addition to this there is an estimated two-man-months of time in acreage compilation and ownership record searching at the county courthouses.

Land-owner Reactions
Reaction of our solicitations for signing agreements varied from immediate acceptance to flat refusal. Many were in agreement with the program but

were reluctant to sign until we stated that actual payment would not be necessary until after the spraying was finished. This seemed to take an immediate financial strain off of them and they were more agreeable to signing when they could plan on the expenditure at some future date.

I would suggest that the State Forester set a definite period for collection and that no collections be made at the time of contact. This would centralize the collecting procedure; keep it in the correct office and discourage cash payments to contacting officers.

Some payments were made direct to the Forest Service, which threw that accounting office in a turmoil; some were mailed directly to the State Forester and some were paid to the local ranger's or state representatives' office. With their varied method of payment no complete record of collections exists in any office but that of the State Forester. I don't think the ranger or his men making agreement contacts should have anything to do with the collections. That is the State Forester's responsibility.

Further effort should be made to get instructions to all field men making contacts; on procedure of writing agreements; number of copies, where to mail, time schedule of mailing and a sales talk prepared by one source so all field men are telling the same story to all cooperators.

12. Contractor ground organization:
Insecticide
Adequate facilities were installed by the contractor. Landing, storage, pumping and metering layout were well arranged. (See diagram.)

One insecticide man was on duty at the pumping station and the spray plane mechanics helped with the loading. This worked with all planes except the Ford. In this instance there had not been a clear understanding between contractor and sub-contractor. Unloading of insecticide was done by the truck drivers and a contractor's representative did not need to be present for this phase of work. Some difficulty was experienced in obtaining first an oral and then a written statement on who the contractor's representatives for insecticide and flying were. No written statement in this regard was furnished by the contractor but no occasion arose which made this absolutely necessary.

The Chief Pilot, in this instance, was more or less a figure-head. He functioned only in tight moments but most of the time the Unit Supervisor dealt directly with the pilot of each plane.

Mr. Heckathorn was on hand during most of the heavy activity and any critical decisions were handled by him, on the spot.

It is recommended that a list of duties, as expected of the contracting officer, be given to the contractor and his chief pilot, definitely outlining what the Forest Service expects the chief pilot's duties to be. There seemed to be no clear-cut responsibility delegated to the chief pilot of the South Continental Unit.

13. See Sketch

14. See Sketch

15. Safety.
The South Continental Unit completed the job of spraying 250,000 acres without a lost-time-accident. The only accident that did occur happened to the communications man. This consisted of a small burn on the palm of one hand while repairing the power generator at the operation base.

No near misses were reported from drivers of vehicles. One sedan (#40-seatherman) had a short in the battery and battery case that nearly resulted in a fire.

Aircraft Near Misses.
17W (Biegert Pilot)
#3 engine burned a cylinder and the plane returned.

117W (Dwyer Pilot)
This could have been a serious one. A local gas tank wagon was used to refuel this plane towards the end of the job. (Contractor's tank was empty of 100 octane gas.) The meter on the tank wagon continued to register gallons after tank was empty. Pilots did not stick tanks but took the meter reading as final. The #3 engine and tank ran dry after 20 minutes flying time. The plane returned rather than switch tanks because of a lack of knowledge of what gallonage remained in #1, 2, and 4 tanks. The plane would have had sufficient gasoline except that the pilots did not trust gas guages.

Contract should specify certain type of proved gas gauges or make it a requirement to stick tanks at each loading of insecticide.

16. Special Study Projects.
(a) Height of Flight Administrative Study
This study made in the Pipestone pass area on blocks 77 through 84 was designed to study the effect of increasing the present spray height on spruce budworm mortality. If the height of flight of planes could be increased without sacrifice in efficiency, the flying hazard could be reduced.

The study was a cooperative arrangement with the Forest Insect Research Division. Mr. Joe Davis of the Beltsville, Maryland Forest Service Insect Laboratory was in charge of the technical direction of the study. Mr. Davis was assisted in supervision by Bohdan Maksymuik.
Six temporary assistants aided in the projects.

The spray in the study area was applied with a B-18 spray-craft at an average height of 750 feet above the forest canopy.

16. (a) Unit Biologist Rowland established and measured development plots in the area and also applied some spray cards in the study area in order to co-orelate the results of the project with results on other areas of the Forest. Transportation inspection and repair, communication, safety and routine supply procedures were handled by the South Continental Unit.

Excellent relations were maintained with men responsible for this study throughout the South Continental project.

(b) Fish mortality in the Big Hole River.
Special instructions were issued to pilots in line with regional policy and guide lines on spraying adjacent to fish streams and the instructions were carried out reasonably well. In the pattern of flying the B-17 (Pilot Dwyer) made several turns at the east end of block 37 across a sharp turn in the Big Hole River after he had shut off spray at 500 feet, and greater height after coming over benches that drop 300 feet or more to the river. Mr. John Hazen, President of the Butte Water Company, reported finding sufficient dead fish in the slack water above the company's dam opposite the mouth of Charcoal Creek as to cause him some concern about the contamination of the water above that point. On July 17th, the day of the report, Fred Mass notified Mr. Scott of the report and then traveled the section of the river from the pumping station dam upstream approximately 20 miles to Bear Bulch making spot checks of the river sections enroute. The Bear Gulch vicinity was the farthest point up the river valley on which spraying work was scheduled and had been accomplished. From these checks it was determined with Mr. Hazen that the number of fish found indicated that some mortality above normal loss of suckers had occurred apparently tied in with spraying dates. No abnormal number of dead trout were found. The largest number of dead suckers were apparently accumulated in the slack water just above the pumping station with lesser numbers above and below.

It is presumed that any effect on the water by spraying apparently occurred through drift from spraying the steep slopes on the north side of the Big Hole River.from Bear Creek down to Charcoal Gulch. Fish found below the pumping station apparently had, or could have, drifted down from the section of river mentioned above.

In order to determine factual data on the fish mortality and to minimize the above for pollution of the river, 2-two-man crews were assigned to search for, count and remove dead fish from the section of the Big Hole River involved. This was on July 18 and 19. Two men worked above the pumping station and two men worked below the pumping station.

The results of their findings were as follows:
Fish counted dead below pumping plan by Forest Service crew, 143 suckers and 2 trout. The suckers averaged 12 inches in length and the trout averaged 6 inches in length.

Fish counted dead by the Forest Service crew above the pumping plant, 32 suckers and 6 Rainbow trout.

16. (b) Some additional data on these counts is covered in memorandum for files by Harvey Rowland, 7/22/57, designated S-CONTROL, Insects, Spruce Budworm, Fish Mortality in Big Hole River.

In addition to the above data collected, Mr. Hazen stated that about 100 suckers and one trout had been counted and removed from the river just above the pumping plant bridge on July 14, 15 and 16 by his own crew attempting to prevent pollution.

17. (a) Exceptionally heavy infestation noted:
The development crew working out of Whitehall collected 177 budworm larvae from one Douglas fir branch 15 inches in length from the Hells Cannyon drainage in the South Continental Unit.

(b) Photographs of project.
We are forwarding a number (100) of photographic prints taken of the project.

Mr. Chester White photographed these 100 prints with Forest Service film.

The 4 x 5 inch enlargements were made by Mr. Rodney Helterline of Butte who also was interested in the project from the photographic potential and contributed the prints. Credit should be given to Helterline for any of his prints that may be used.

(c) Information and Education:

Every opportunity to further understanding with the public on the project was taken.

The Spruce Budworm film was worked over to delete objectionable sections and was shown on several occasions with introductory remarks by Forest officers. The subject was discussed in many small and large gatherings including both official and other meetings of local people.

Some of the larger or key audiences informed were through such mediums as:

1. Television - KXLF, Butte, live program in the fall of 1956.
2. Spruce Budworm film on KXLF, Butte Television in 1957.
3. Talks to Lions Club, Exchange Club and Kiwanis Club with above film.
4. Talk on KOPR Radio in the Spring of 1957 in conjunction with fire prevention.
5. Discussed in stock association meetings throughout forest.
6. Large signs and display case and facilities for explaining operation to prople visiting Butte operation.
7. Show me trips to operation base and laboratory.
   (a) Several small groups and key individuals.
   (b) Show me group on the 12th of July arranged by State Forester.
8. Full sheet spread w/photographs in Montana Standard.
   Day to Day news items on the project as it progressed both in Montana Standard, Butte Daily Post, KXLF Television and radio news.

Part II

Biological Aspects in Relation to Administrative Program

1. Prespray insect development checking

A. The total number of insect development checking plots established in the control unit were eighty-seven regular plots and five supplemental plots.

B. See attached map

C. Classification of development checking plots.

1. Aspect groups:

(a)	N	10	(b)	Ridge	45
	NE	1		Creekbed	22
	E	12		Flat	5
	SE	7		Slope	15
	S	12			
	SW	4			
	W	12			
	NW	7			
	N&S	1			
	Unclassifiable	17	(All exposures)		

2. Elevation Groups

5000' to 6000' - 24
6000' to 7000' - 50
7000' to 8000' - 13

3. Timber Groups

Douglas Fir - 85
Spruce - 2

2. A. Eight days elapsed between initial alert report (June 24) and date of first block released.

B. No delay in start of spraying.

C. Two blocks were released for spraying on July 2. Six additional blocks were released on July 3, but wind prevented spraying operations. Twelve more blocks were released on July 4 for a total of over 62,000 acres of which approximately 20,000 was sprayed on July 2 and 4. Eight blocks were released on July 5 and approximately 19,000 acres were sprayed. Fifteen additional blocks were released for a total released area of 145,967 acres in the morning of July 6. However, on July 6 a total of seven planes sprayed over 48,000 gallons of insecticide and from that date on the sprayed acreage exceeded the newly released acreage so the average delay between release date and spray date was less than three days with many blocks being treated on the day they were released.

3. A. The 1000 feet altitude limitation worked very well. The only problem was in establishing a boundary that could be easily located from the airplane.

B. Very little change was required in boundaries due to aspect.

C. Acreage limitations were only exceeded in a few blocks. The largest block was the McCarthey Mountains with 5,463 acres. It was impractical

to divide this area since no photos were available for the western portion of the area. Some blocks had less acreage than the minimum due to boundary adjustments on dropped acres.

D. It is recommended that the same standards for altitude, aspect and acreage be maintained, but that the forest officer be given some latitude in extablishing the boundaries of blocks in which topography prevents strict, compliance with the standards.

4. A. Where interior areas were openings, little difficulty was encountered, although the height-of-spray crew found as much deposit on their cards in an "out" area as they did in the block. Where topographic features or small openings aided the pilots, lodgepole areas could be omitted, but in at lease one case it was necessary to include part of an out area due to the difficulty of determining the exact location from the air.

B. 1. Minimum size and shape depends upon two factors - the size of the plane and the topography of the area. The larger type planes cannot miss as small an area as the Ford Trimotor. It is believed that the minimum of 125 acres should be retained. Out areas along the summit of a ridge are easier for the pilot to omit than those in a canyon or a low area surrounded by higher elevations. Areas that follow generally along contours are easier to omit than those that cross contours.

2. Delineation of host and nonhost type without the benefit of topographic features is impractical unless the timber stand has openings that can be used to guide the pilot.

3. Ridges, drainages, roads and other topographical features and landmarks provide the best guide to the pilot for area boundaries both exterior and interior.

5. A. Provide a percentage chart for each development checker to eliminate the need for computation to complete SBW-17 forms. See attached sheets.

B. Provide each unit with an instar development record chart. See attached.

C. Design training charts for use in training development, spray cards and mortality checkers on the same basis as those used for BRC and lookout-fireman training.

D. Provide unit mechanic with "Random Inspection Report" forms for use in daily safety and service inspections. See attached sample.

E. Provide cloth pillow covers with zippers for use as pre-spray population collector bags. Plastic bags are too easily torn.

F. Provide small syphon hose and clamp for use a gravity feed for partially filling vials with chemical from gallon cans or jugs.

6. A study should be made to provide a more reliable standard for the number of branch samples needed on the pre-spray population counts. It would seem that 20 branches may be sufficient on heavily infested areas where 100 or more larvae are obtained. On medium infested blocks 40 branches may be needed. On blocks with very low populations it may be necessary to take 100 branches in order to get reliable results. It is believed that the post spray mortality should be kept at double the pre-spray branch number.

Elevation 5515

Gate Light

Washing Facilities

Parking lot

Barrier lights

Phone Line Underground

Trailer

Briefing Tent

Comm. Tent

3 Phase Junction Box

Toilet

Generator

Under ground Power Cable

Antenna - Flag Pole

Aircraft Parking

TRUCK DRIVEWAY

WALK WAY

TAXI (LOADED PLANES)

CBN B-18

LOADING

Meters

Gasolene

Gas Lines 6" Suc. Line

Gasolene Pump

GAS 10,000 Gal.

Gasolene

Truck unloading Valve

Ford TBM

LOADING

Meter

Pumps

Suction Line

6000 gal. 25,000 gal.

3"07 Line

Air Eliminators

Gasolene

Meters

TAXI (LOADED PLANES)

B-17

LOADING

TAXI

60'

TAXI STRIP — 1150 feet to Landing Runway #33

(See small plat

Asphalt RUN WAY 1

5563 feet

By pass for Small Planes - Ford TBM

S
Control - Deerlodge
SBW. - South Continental Unit - 1957

#14 This was about the best layout of loading facilities that could be arranged. The only suggestion for improvement would have been to oil the taxi strips and plane parking areas to eliminate the constant watering problem. Dust would have been extreme if it had not been for the 18,000 - 24,000 gallons of water that was sprinkled daily.

OPERATIONS BASE

South Continental Unit — Butte, Mont - 1957

CAE + Fitton

Center Circle is 150' Diameter

Dirt Road

ELEV. 5514

ELEV. 5514

DETAILS OF LOADING AREA GIVEN ON LARGE DRAWING

TAXI

5563

5537

CAA MU/WAL

TAKE-OFF

5545

LAND

ELEV. 5522

Elev. 5526

ELEV. 5526

ELEV. 5545

ELEV. 5554

Dirt Road

U.S. Highway 10S

MUNICIPAL AIRPORT
BUTTE, MONTANA

NFA-SBW Form 2
Jan. 1957

AERIAL OBSERVATION REPORT
Spruce Budworm Control

DATE _____
OBSERVATION FLIGHT TIME

TIME OUT	TIME IN	TOTAL TIME

1. Plane_____ Spray Block_____ Time _____
2. Swath width_____
3. Swath location w/respect to previous swath_____
4. Spray plane height_____
5. Leaks or plugged nozzles_____
6. Spray action_____
7. Spray pattern near lakes or streams_____
8. Is the spray plane in proper block?_____

Date _____ 195___ Observer_____

Remarks:

_____
OBSERVER

AERIAL BRIEFING REPORT.

1. PLANE # _____ PILOT. _____ BRIEFING PILOT _____
2. AREA _____ BRIEFING OFFICER _____
3. REMARKS

SIGNED: BRIEFING OFFICER _____
BRIEFING PILOT _____

NFA-SBW Form 12
Jan. 1957

Control Unit

RECORD OF ~~OBSERVATION~~ NON-SPRAY PLANE FLIGHTS

Contractor | Pilot | Aircraft Type and number

Date	Flt. no.	Flying time Out	Flying time In	Flying time Elapsed	MAMES Load Pass. No.	MAMES Load Frt. #s	Mission Route & Flight Plan	Flying Time Summary: Briefing	Observing	Ferry & Other (Specify)

Flights authorized by _____

Contractor representative's Signature _____

Unit supervisor's signature _____

INSTRUCTIONS FOR USE

1. Use daily.
2. Under "Flying Time" "Out & In" record reading from aircraft tacometers or "Recording Tac". Allow incoming taxi and parking time only. No warmup time is included. If aircraft do not have recording tacometers, use standard time, allowing time from take off to landing and parking.

South Continental Unit

Daily Airplane Roster.

Butte Airport

Operation Base

~~Airplane Roster~~

Instructions:

1. Prepare in triplicate with signature for column A daily.
2. If delay involved forward copy to RO with entries and signatures for Column B.
3. Notify RO in writing when delay corrected w/time and date and signatures entered in Column C

Work Order # _____ ~~Required~~ _____ (Date)

COLUMN A			COLUMN A		COLUMN B.						COLUMN C	
R. O. ORDERED			ORDERED TO WORK									
CAA Plane Number	Time	Place	CAA Plane Number	Time	Planes Made Available by by Contractor As Ordered	Planes Not Delivered As Ordered	Reason For Delay	Time Delay Started On Planes Not Available	Time Contractor Notified of Delay Oral	Written	Time Delay Ended	Copy of Delay Notice to R. O.

Order Confirmation
Ordered By: _____ (Unit Supervisor)
Received By: _____ (Contractor Repr.)

Delay Confirmation
_____ (Unit Supervisor)
_____ (Contractor Repr.)

Corrected Deficiency Confirmation:
_____ (Unit Supervisor)
_____ (Contractor Repr.)

NOTIFICATION TO CONTRACTOR OF DEFICIENCY OR DELAY

Work Order # _____ Prepared _____ (Date)

	COLUMN A		COLUMN B		COLUMN C		COLUMN D	
ITEM	AMOUNT AND LOCATION OF DEFICIENCY	CONTRACTOR NOTIFIED DEFICIENCY EXISTS TIME / DATE	ITEM OF DEFICIENCY SUPPLIED & CORRECTED AS ORDERED TIME / DATE	DELAY STARTED CAUSED BY DEFICIENCY TIME / DATE	REASON FOR DELAY	DELAY ENDED TIME / DATE	R.O. NOTIFIED TIME
	Notification of deficiency confirmation:		Deficiency ended confirmation:	Start and cause of delay confirmation:		End of delay	
	Unit Supervisor		Unit Supervisor	Unit Supervisor		Unit Supr.	
	Contractor Representative		Contractor Repr.	Contractor Representative		Contr. Repr.	

INSTRUCTIONS:

1. Prepare in triplicate with signature for columns A and B daily.
2. If delay involved forward copy to RO with entries and signatures for Column C.
3. Notify RO in writing when delay corrected w/time and date and signatures entered in Column D.

UNIT SUPERVISOR'S PROJECT CHECK LIST

- Crews Safety Conscious: _____

  Hazards noted: _____

  Action taken: _____

- What blocks to spray today: _____
- What blocks released today: _____
- Probable blocks to release tomorrow: _____

  Probable additional blocks to release w/in 3 days: _____

  Remarks: _____

  _____

- Pilots briefed adequately _____ effeciently _____

  Maps and Mosaics up to date with needs _____
- Weather men dispatched _____ Communications _____

  Briefed properly _____ What areas _____
- Spray card checkers dispatched _____ Areas _____

  Analysis of cards OK _____
- Mortality checkers completing studies in time requirement _____

  _____ _____ Accuracy _____

  What areas today _____
- Development checkers assigned to logical areas _____

  Accuracy and adequacy of samples _____

  What blocks today _____

- Airport Maintenance up to standards _____
  Dust-Sprinkler Schedule

  Taxiways _____

  Signs _____

  Tents Trailer

  Insecticide tanks, pumps, meters _____

  Gasoline tanks, pump, meters _____

  Electric System _____

  Parking area _____

  Latrine _____

  Public Relations facilities _____

- Public Relations

  Newspaper report today _____

  _____

  _____

  Television _____

  Radio _____

  Special Visitors _____

  _____

Show-me trip arrangement needs for today _____

_____

Show-me trip arrangement needs for future, when, what _____

_____

Unit Supervisor's Project Check List (Cont.)

Forms to be reported on by Unit Supervisor daily:	Responsibility
∘ Control Project Report - Laboratory Wall	Rowland - Mass
∘ SBW 10 - Spray Block Acceptance & Approved Record	Rowland - Mass
∘ Notification of Deficiencies	
Aircraft Roster	Hofferber - approved by Mass
Insecticide and Other	White approved by Mass
∘ Is signature of Contractor Representative obtained _____	
∘ SBW 12 - Record of Observation Plane Flights	Authorized by Hofferber (Contractor & Mass Signature)

∘ At Operations Base:

Are payrolls, purchase and rental records up to date _____ _____

Remarks _____

∘ SBW 2 - Aerial Observation Report — Sweet, Approved by Hofferber

Remarks _____

∘ SBW 3 - Safety Inspections Being Made — Hofferber

Unit Supervisor's Project Check List (Cont.)

SBW -3

Responsibility

Operation Base _____

Insecticide and Gas Loading Area _____

Laboratory _____

Field _____

Aircraft _____

Motor Vehicles _____

Height of Flight Crew _____

Remarks _____

- SBW-4 - Daily Aircraft Certification Report — Pilot, Chief Mechanic, Hofferber

Remarks _____

- SBW-5 - Spray Period Weather Report Record — Weather Observer approved by Hofferber

Remarks _____

- SBW-6 - Individual Daily Spray Plane Record — White w/spot checks & approved Hofferber

Remarks _____

- SBW-8 - Daily Spray Coverage Report — white

Remarks _____

- SBW-9 - Record of Insecticide Sprayed on Individual Blocks — White, approved by Hofferber

- SBW-11 - Insecticide Inventory Record — White

Remarks _____

- SBW-13 - Daily Log Record of Over-all Activities Including Record of Messages, Telephone & Radio Calls of Importance — Operator, checked by Hofferber

Remarks _____

Unit Supervisor's Project Check List (Cont.)

	Responsibility
○ SBW-14 - Pilot, Spray and Observation Aircraft Inspection	Hofferber
Remarks _____	

At Laboratory

○ SBW-15 - Spruce Budworm Infestation Check Sheet	Rowland
Remarks _____	
○ SBW-17 - Budworm Checkers Daily Report	Rowland
Remarks _____	
○ SBW-18 - Daily Budworm Larvae Development Record	Rowland
Remarks _____	
○ SBW-19 - Spruce Budworm Development Plot Data	Rowland
Remarks _____	
○ Daily Random Vehicle Inspection Report	Cottrell, Hofferber
Remarks _____	
○ Other Agreement for Transfer of Aircraft	Hofferber or Mass

U. S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
F. A. SILCOX, CHIEF
T. W. NORCROSS, CHIEF, DIVISION OF ENGINEERING

DEERLODGE NATIONAL FOREST
MONTANA
PRINCIPAL MERIDIAN, MONTANA
1938

Scale
3 1 0 1 2 3 4 5 6 Miles

LEGEND

- National Forest boundary
- Adjacent National Forest boundary
- County line
- Game and bird refuge boundary
- Good motor road
- Poor motor road
- Trail
- Poor pack or foot trail
- Railroad
- Telephone line
- Telephone line along road
- Telephone line along trail
- Electric power station
- Electric power transmission line
- Pipe line or conduit
- Forest Supervisor's headquarters
- District ranger station
- Guard station not permanently occupied
- Administrative pasture
- Administrative site
- National Forest land
- Camp ground
- Triangulation station and permanent lookout station
- Permanent lookout station
- Patrol lookout point, improved
- Patrol lookout point, unimproved
- Municipal landing field
- Intermediate landing field
- Auxiliary landing field
- Airway light beacon, flashing
- House, cabin, or other building

Spruce Budworm infested areas to Oct 1951
10-12-51

Compiled at Regional Office, Missoula, Montana, from U. S. G. S., G. L. O., Forest Service, and other surveys by R. H. Boutilier, 1937
Traced at Regional Office by D. A. Gregory, 1937

Polyconic projection
North American datum

Longitude west 50′ from Greenwich

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